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COAL IN INTERNATIONAL TRADE

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COAL
IN INTERNATIONAL
TRADE

BY

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PREFACE

This little book is not a scientific treatise; its purpose is to provide matter for thought, to suggest problems rather than solutions. It is an attempt to place side by side certain groups of facts which are intimately related but not easy to study in their widely scattered sources. The method involves the comparison of things not strictly comparable and the use of figures subject to large initial errors in addition to the errors inevitable in handling and reproduction. A rigid statistician may take refuge in economic agnosticism; he may argue that nothing of real value can result from material so imperfect; such material, however, is sometimes better than none. The world will not await ideal statistics either for argument or for action; and where evidence is cumulative, a very considerable correction for error may leave the essentials of the picture untouched. In the sphere of commerce, even an approximate estimate of the factors entering into competitive price is not without value, though their exact determination may require minute investigation by the expert.

A. J. S.

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CHAPTER I

During the last five years of the nineteenth century, the world's annual production and consumption of coal, anthracite and bituminous, averaged a little over six hundred million tons; in 1913, the production was approximately twelve hundred million. Of this vast mass, over eighty per cent. was raised in three countries—the United States, the United Kingdom and Germany—and well over forty per cent. in the United States alone. Adding to the German total the quantities raised in Belgium, northern France, Bohemia, and the Austrian and Polish margins of the Silesian area, we find about ninety per cent. of the world's coal produced either in the United States or in a narrow belt of country extending from the upper valley of the Oder through Central and Western Europe to the Atlantic margins of Great Britain. In these two regions of the old and new world are to be found the chief homes of world industry, the centres of attraction for a great flow of foodstuffs and raw materials, and the points from which manufactures, and to some degree coal itself, move outwards to regions less favoured by nature. Such movement may be national or international; within or across existing political boundaries; but in either case its volume is related nearly to the quantity of coal raised. The exclusive study of international trade statistics tends to obscure this fact. The movement to and from the coal regions of North America, for example, is of vital importance in the economy of the world, although it is mainly internal.

The direct movement of coal in bulk across national boundaries, important as it is or was in the economy of Great Britain, affects less than fifteen per cent. of the world's production; so that the indirect movement, in the form of goods based on the industrial use of coal, while more difficult to track out, is in reality far more important from the viewpoint of world economy. The trade in coal, recorded as international, depends on the accidental position of political boundaries in relation to certain permanent geological facts. By land, the movement is usually over somewhat short distances; and the "country," the political unit, rarely provides a sound basis for its investigation. Areas rather than countries must be studied; though, unfortunately, the most easily accessible statistics are by "countries." Let us see how far such figures will carry us.

The three chief producing countries, in 1913, naturally provided the greater part of the surplus for export. In Europe, the chief deficit countries were France, Austria-Hungary, Italy and Holland. Of these, Italy was supplied by sea, Austria and Holland mainly by land, France both by land and sea. Baltic Russia and the Scandinavian and

Iberian peninsulas may be classed as secondary deficit countries. Of the two surplus regions, Germany dominated the land trade of Central Europe, and Britain monopolized the Mediterranean markets; while in the countries on the western margin of the Continent there was competition, of varying degree, between these two sources of supply. On the other side of the Atlantic, the surplus from the United States found its chief outlet in eastern Canada. The only other deficit region of much importance was to be found in Brazil and the River Plate countries, supplied mainly from the United Kingdom.

Such are the broad lines of the distribution of coal to the chief deficit areas in this particular year. At once we are faced with the question of the permanence of the distribution. In other words, is the production or surplus in 1913 a fair index to the relations of the chief competing areas in the near or more distant future? The answer depends on two factors—the quantity of coal available and the cost of putting it on the market. Industry and commerce are, and are likely to remain, competitive, as between the members of different political units, so that the second factor is no less important than the first. Moreover, the two factors are closely related. Quantity and accessibility, or ease of working, commonly go together; ease of working affects cost of production; so that the question of reserves of coal is not without a bearing on the present organization of the mining industry.

For purposes of rough analysis, the world reserves of ordinary coal, anthracite or bituminous, may be taken as a round four million million tons (4,000,000,000,000). The estimate of the geologists exceeds this, while the amount commercially available is likely to be considerably less; but the figure is useful as a basis for division and comparison of one producing region with another. The figure, in itself, conveys little to the ordinary mind; it becomes more significant when translated into the form of supplies for upwards of three thousand years at the present rate of world consumption. The possibility of exhaustion seems to be hardly a matter of interest, still less of anxiety, to the present generation. The interest may perhaps become more evident if we consider the case of particular countries or regions.

How, then, is the world reserve of coal distributed; how related to the chief regions of present production? Briefly, at least half may be assigned to North America, mainly to the United States; a quarter to China with distant Siberia, and rather more than a fifth to Europe. The remainder is shared between the minor fields of Japan, India and the Southern Hemisphere, the only reserve of any real moment lying in New South Wales. In addition to true coal, the world possesses stores of "brown coal" or lignite estimated at nearly three million million tons (3,000,000,000,000). Of this over ninety per cent., so far as is known, lies in North America. The European reserve is relatively small; though Germany with over eighty million tons and Austria-Hungary with about thirty-five million accounted for most of the actual world production in 1913.

In all cases the estimated reserve of coal is considerably greater than the quantity which will ever be brought to the surface, owing to the waste, necessary or unnecessary, incidental to mining; but the comparative figures are not without significance, since the nearer any particular field approaches to exhaustion the higher is likely to be the cost per unit of coal raised. This probability is based on pure geological or physical conditions and is independent of the efficiency of local labour; but it is worth serious consideration that half the world reserve is in a region where labour is generally dear, but efficient and amply backed by capital, while a quarter is in a region where labour is abundant and cheap, but distinctly efficient at the price. In each case, though for different reasons, there is the probability of low cost of production per unit. These two regions, however, are of great extent, whereas coal only moves economically, by land at any rate, over moderate distances. As soon as the element of competition is introduced, the positions of the mining areas and their share of the total reserve of the whole country must be defined with greater precision. The political boundary and statistics based on it are far from being efficient guides to the economics of coal. Coal on the surface in the far interior of the Chinese Empire or Siberia may be as ineffective from the point of view of world industry or trade as coal in England buried at inaccessible depths beneath the earth; though the former may appear in statistics while the latter is ignored. Let us then consider the problem of accessibility in its bearing on the actual organization of industry and commerce. For this purpose, a map showing communications carries more suggestions than many columns of statistics.

Of the actual production of the United States —over 500,000,000 tons in 1913—nearly three-quarters is to be found in the great eastern field which stretches in a long belt through Pennsylvania, Ohio, Western Virginia, Eastern Kentucky and Tennessee to Alabama. This field is the main basis of American industry and source of the coal exported. At the present rate of production, its reserves are calculated to last from twelve to fifteen centuries. Farther west, but in close touch with Lake Michigan and a region of rapidly growing industrial activity, is the interior field of Indiana and Illinois. These two great fields provide together some ninety per cent. of the coal mined in the States, and contain two-thirds or more of the commercially accessible coal of the country. At the present rate of production they will last for well over fifteen centuries. There are large deposits in the far interior, and some on the west coast, but it is clear that these eastern fields alone need be considered in relation to the world of to-day or the near future.

Canada, at the moment, is a deficit country, in spite of its possession of reserves amounting perhaps to a fifth or a sixth of those of the United States. Unfortunately, two-thirds of these lie in the western interior, in Alberta, and the remainder for the most part in British Columbia; while the centres of industry and population are in the east, in Ontario and Quebec. The reserves on the Atlantic coast are relatively small, while the present output finds local markets; so that Canadian industry is dependent largely on coal imported from over the border. Before the war, eastern Canada, the region of the St. Lawrence and the Lakes, was the chief market for the exported surplus of the neighbouring coal area of the United States. In spite of the vast production of the field, this surplus was very modest —in all about twenty million tons; of this, Canada needed nearly three-quarters, that is about as much as her total home production.

At the other side of the world lies the Chinese area, with a total output, in 1913, considerably smaller than the American surplus. It is a field of the future; up to the present only the outside edges have been nibbled. The coal of Shantung, Manchuria and Chili, developed under foreign influence, is already an item to be recognized in the trade of the Pacific; while the vast Shansi field, in the far interior, is slowly responding to the impulse of the railway and extending its influence over the great plain. Present conditions, however, are no sure index to the future. Railways and mines alike are the result of mixed political and economic motives operating from without. China is not yet possessed of the strong organization necessary to develop her great resources. Perhaps three-quarters of the total reserve of the Chinese area is to be found in the Shansi district; and until the country effects drastic changes in its mode of life this huge store of coal is not likely to make an impression on the world's economy corresponding in any degree to its bulk. None the less, it is there, and to be reckoned with at some uncertain date in the future. The more accessible supplies, in the districts near the coast, if seriously exploited would not last for many generations, if the estimates of the geologists are to be trusted.

Let us turn now to the most highly developed of the three great coal regions, Western Europe, the region, be it noted, which has also the smallest reserve. Here, the life of important sections must be counted by hundreds rather than by thousands of years. In this region, whether from the point of view of present production or future resources, Great Britain and the German Empire of 1913 are alone worthy of detailed treatment. Of the total raised in 1913 in central and western Europe—rather over 550,000,000 tons—the share of Great Britain was 287,000,000 or more than a half, and that of Germany 188,000,000, or a full third. The next in order of importance was France, a deficit country, with only a fourteenth of the European total to its credit. On the other hand, of the total estimated reserve of some seven hundred and fifty thousand million tons, only a quarter was assigned to Great Britain and more than a half to Germany. Reserves are far from being proportional to present output. At the rate of production of 1913, Britain had supplies only for five or six centuries, Germany for eighteen to twenty. The British supplies being smaller in total quantity, and mining being relatively more developed, the area is in consequence nearer to the stage of exhaustion.

As the British fields are all within easy reach of the sea, the precise location of the various reserves is a matter of local rather than of international importance. The case is otherwise in Germany, where the two main fields are widely separated, serve areas quite distinct, and are closely related to very different international boundaries. Of the total German output of 188,000,000 tons in 1913, about sixty per cent. was raised in the great Ruhr coal area, in the immediate neighbourhood of the Rhine, and rather over twenty per cent. in the valley of the Oder in Upper Silesia. The remainder was accounted for by the Saar and Aachen fields, west of the Rhine and near the frontier, together with the small Saxon and Waldenburg fields near the borders of Bohemia. The Ruhr or Westphalian area is estimated to contain about half the reserves of the German Empire, while the Silesian field has some forty per cent. The importance of the latter is increased slightly if we add the reserves of those fragments of the coal measures lying beyond the old Polish and Austrian frontiers. It is evident that these two great fields, in the west and east, must remain the chief centres of industry based on coal, and that, on a long view, the smaller German fields may be ignored. The Bohemian field, in spite of its present local importance, has rather less than a sixth of the resources of Upper Silesia; while the reserves of France and

Belgium together are about equal to those of Bohemia.

We are left, then, with two regions of primary importance in the United States and two in central and western Continental Europe, together with the scattered fields in Great Britain. The three groups differ widely from the standpoint of international trade. The American group is removed from the sea by a long rail journey and has only one market across a land frontier; the German group has the advantage of river navigation for each of its main sections, particularly the western, and is surrounded by inland markets; while the units of the British group lie for the most part quite near to the sea and have as a possible market the whole coast region of Europe, the Mediterranean and the Atlantic. There is competition, direct or indirect, between the groups, and to some extent between the units which constitute the groups, but geographical conditions provide only one of the factors to be considered whether in the present or in the future. The second factor belongs to the realm of economics and merits a new chapter.

CHAPTER II

Coal in the earth represents merely certain possibilities; it becomes commercially effective mainly through labour. Labour is the largest factor in the price, and price is vital in a world of competition. Labour-cost is not simply a question of wages, but of wages in relation to efficiency, and the most important measure of the efficiency of a mining system is the output per unit of labour employed. A comparison of the European and American systems, on the basis of such output, yields somewhat startling results. Just before the war, Great Britain employed well over a million people in and about the mines to raise its coal; the United States about three-quarters of a million, and Germany somewhat less than seven hundred thousand. Combining these figures with those of the tonnage of coal raised, we find that the output per person employed was nearly 680 tons in a working year in the United States, but only some 260 tons in Great Britain and about 270 in Germany. History adds emphasis to this remarkable contrast. The American output rose steadily from an average of 400 tons in the period 1886–1890, while that of Great Britain fell from somewhat over 310 tons per person. The German output per head was approximately the same at the end as at the beginning of the twenty-five years and passed that of Great Britain for the first time in 1912. Among the smaller fields, Australia increased from 330 in 1886–90 to 540 in 1912 and Natal from 100 to 260 ; only Japan with 120 and India with 111 tons remained considerably below the British level in 1913. The figures may not be in all cases strictly comparable, but no correction for possible error can alter the main facts. The differences are far too great to be explained away by any juggling with statistics.

Statistics, however, particularly those relating to mining, are somewhat dangerous bases for argument, when the argument comes first and the proof is sought afterwards. The figures above are not rigidly comparable, nor are they an index to the personal efficiency of the individual "miner" in the different fields ; still less to that of the miner proper—the hewer of the coal. Not only the relative efficiency of the miner, but also the number of effective working days in the year, the number of hours per day, the amount of machinery employed, the thickness and uniformity of the seams worked, and other physical or geological factors, all have a bearing on the quantity raised. None the less, explanation, though it may provide some mental satisfaction, cannot alter the essential facts of the case. We are concerned, here, not with the analysis of the mining industry but with the final result—coal as a commercial product used for manufacture or trade under conditions of competition. From this point of view, the quantity raised per head is of vital concern, since it is related closely both to wages and to market prices. The amount to be realized by the sale of 680 as compared with 260 tons evidently provides a very wide margin available for distribution between the capitalist and the wage-earner; while some of the advantage may be passed on to the consumer in the form of lower market prices.

The world of commerce starts with the pit-mouth price of coal as the basis of its operations; it is not concerned directly with the relative remuneration of the miner and capitalist, or with the return to the mining industry as a whole in any particular country or area. It will not and cannot pay more than the competitive market price, through a sentimental regard either for the pocket of the unfortunate investor or for the "standard of living" of the miner, whatever that may be. International trade takes no account of a national system of wages, however fixed, and whatever its moral or political justification may be. It recks as little of Legislatures as of Trade Unions, and refuses, in the long run, to buy in other than the cheapest market. Producers can fix their own price only when they possess a monopoly of the supply of some essential commodity, and even in such cases it is possible by exacting too much to destroy, wholly or in part, the consuming market. Starvation not infrequently ends in death, whether the food lacking be bread or coal.

The American advantage over Europe is even greater than the above figures suggest. These are based on the production of coal of all kinds throughout the country, and include the anthracite mines where the difficulties and costs are greatest and the opportunity for the application of machinery is least. In the bituminous coal areas, the chief bases of present and future competition, the production per unit employed was higher than the average—not far short of 750 tons. It was highest of all in the eastern section which lies nearest to the sea and is the real centre of American manufacturing activity. Here are no mines with deep shafts, but massive deposits, thinly covered, and trenched by rivers, so that they may be reached by shallow borings or by adits from the valley sides. The coal, hauled up from the mine by gentle slopes, or run down by gravity, can be dropped into barges or on to the railways which follow the terraced banks of the rivers. Access could scarcely be made easier, while the thick and uniform seams are excellently adapted to cutting machinery. In 1913, about fifty per cent. of this American bituminous coal was machine-mined, as against less than ten per cent. in Great Britain. Twenty-five years earlier, machinery was scarcely used, though even then the American output per head was much greater than the British. The increased use of machinery is clearly one of the causes of the ever-growing difference in output. Hand labour alone, except perhaps in China, can never compete successfully with the combination of skilled or semi-skilled labour and capital in the form of machinery.

The advantage of the United States as compared with Europe is evident: its commercial measure is to be found in the pit-mouth price of coal in the two regions. The average price per ton in the United States in the middle eighties of last century was about 6*s.*; after a fall in the nineties it rose again and remained very near the six shilling level during the present century up to 1912. Over the same period, the price in Great Britain, starting from the lower level of a little under 5*s.*, rose gradually to 9*s.* in 1912. Germany showed a similar movement from 5*s.* to over 10*s.* On the other hand, Australia and Natal both show decreases and were both producing in 1912 at a lower cost than Great Britain. There is thus a marked correspondence between output per head and price, and it is clear that America enjoyed a progressive advantage over Europe based not merely on the volume of her production but also on its relatively lower cost. Though her external trade in coal was small, the advantage affected all those industries in which the price of coal is an important or determining factor. It is worth repeating, in this connexion, that neither America nor Australia was a country of low money wages, as compared with Europe.

We have touched briefly on the factors affecting pit-mouth price—the base from which we start in commerce; let us now follow the movement of coal in international trade and consider from this standpoint our surplus areas in Europe and America. Here, the key to the understanding of the whole movement is the export of the surplus from Great

Britain. We are dealing with a total of some seventy-three million tons of coal, not including some three million tons of coke and manufactured fuel. Let us consider broadly its destination in 1913. Six-sevenths, or upwards of sixty million tons, found a market in Europe and the Mediterranean. South America accounted for about seven million; while most of the remainder was scattered about among the island coaling-stations of the Atlantic and along the West Coast of Africa. Somewhat over half a million tons passed through the Suez Canal, and this quantity was tending to diminish, since Australia, South Africa and Japan, in addition to supplying their own needs, have a surplus for distribution over the Indian Ocean and the Pacific. On the large scale, Europe and South America are alone of much interest as markets.

Continental Europe possesses within itself a surplus area, so that deficit countries might draw either on this or on Great Britain for supplies. A large part of the continental deficit was accounted for by the needs of France, Austria-Hungary, Italy and Holland. The net requirements of France were nearly twenty million tons of coal and the equivalent of another four million tons in the form of coke and briquettes. The Austro-Hungarian deficit, measured in coal, was about fourteen million, that of Italy rather over ten and that of Holland about eight, giving a round total of fifty-five million tons for the group of countries.

Let us consider France. In 1913 French ports received about thirteen million tons of British coal;

the remainder came by land from western Germany and Belgium, with a little from Holland. Belgium, however, is really a deficit country, with a net excess of imports over exports equivalent to over three million tons of coal. The imports came largely from Germany, and to a smaller extent from Great Britain, Holland, and even from France; while France was the chief market for the exports. In effect, we may consider that France really drew on the German surplus by way of Belgium, while Great Britain supplied most of the small net deficit of Belgium, mainly in the shape of coal for bunkers. Of the Austro-Hungarian import, about a million tons entered the Mediterranean ports by sea, while the remainder crossed the northern frontier from the Silesian coal area of Germany. Holland was supplied chiefly from the Ruhr field of western Germany, either by rail or river, and received in addition small quantities of British coal; while Italy depended on us for over ninety per cent. of her supplies, the rest coming for the most part from Germany.

The picture is still incomplete and misleading. Germany had a gross surplus of nearly forty-five million tons exported as coal or coke, but her real surplus was only about thirty-five million, since, in addition to small quantities from Austria, Belgium and Holland, she received nine million tons from Great Britain. This entered mainly by Hamburg and the Baltic ports, though a little even penetrated by the Rhine. There is evidence, in this trade, of the advantage of sea transport, since Westphalian coal, rail-borne, is unable to oust the British product at Hamburg. From the standpoint of Europe as a whole, we may regard this nine million tons as releasing at an economical price an equivalent quantity of German coal, either in the west for the benefit of France, or in the east for Austria-Hungary; and it is clear that two-thirds of the European deficit was really supplied from the British surplus and only one-third from the German.

The only other large market, in Europe, for British coal was to be found in the Scandinavian peninsulas and Baltic Russia, which together absorbed in 1913 between fifteen and sixteen million tons, or a quarter of our total export to Europe. Here, owing to the position inland of the German fields, British coal easily dominated the market, except for some competition in the Baltic from Silesian coal, particularly in 1912, when the coal strike gave our rivals an opportunity of which they were not slow to take advantage. Enough has been said to illustrate the dependence of important areas in Europe on imported coal for the prosecution of their industry and commerce. Before the war, the two surplus countries, island and Continental, with roughly similar conditions and costs of production, divided between them the European market, and this division in certain parts of that market was not seldom determined by very narrow differences in price.

Let us turn now to the United States, the only other possible competitor in the regions of the Atlantic. The surplus in 1913, on a production of over five hundred million, was about twenty million tons ; but of this only about a quarter was available for export overseas, the remainder going to eastern Canada. The most important outlet, overseas, for American coal was to be found in Cuba, the West Indies, and the mainland of Central America. Only a bare half a million tons reached Europe, the chief market there being Italy ; while South America, mainly Brazil and Chile, took about the same quantity. Some American coal also reached Egypt and the West Coast of Africa. Half a million tons, as against sixty million, seems of very slight significance ; but a very small trickle may, in favourable conditions, grow to a large stream. The measure of such conditions is delivery price. Let us consider the position at Genoa, in 1913, where American and British coals were selling side by side, and, we may assume, at the same price for the same quality.

The American exporting mines, producing at very low cost but handicapped by their distance from the coast—over three hundred and fifty miles—were yet able to put down good quality coal at Hampton Roads at a total cost of 12*s*. to 13*s*. per ton. Cardiff coal, of rather better quality, was 18*s*. to 19*s*. on board ship during the same period. Hampton Roads, however, is over four thousand miles from Genoa, Cardiff under two thousand, and the freight rate from the first is higher. With a rate of 8*s*. to 9*s*., Cardiff to Genoa, American coal must be carried at 14*s*. to 15*s*. per ton in order to compete on nearly equal terms. In each case the coals may have been carried in British ships, working for a profit, that is under normal economic conditions. Prices and freight rates vary from day to day, and it is difficult to get an exact comparison, particularly as the quantity of the American export during the year was very small compared to the British; but we have here a rough measure of the amount of protection, in 1913, afforded to British coal in European markets by the breadth of the Atlantic. There is a further protection in the fact that return bulk cargo from the Mediterranean region to the United States is lacking, except for a moderate quantity of iron and copper ore shipped from Spain.

In the South American market the position was different; Cardiff is at a slight disadvantage, as compared with Hampton Roads, in the matter of distance. In the autumn of 1913, the average rate from Cardiff to the River Plate was 17*s* 6*d*., about double that to Genoa at the same period. Clearly, on the basis of mere distance, American coal could be delivered more cheaply than British. The protection in this market depended not on distance but on the comparative economy of working of the ships—on the fact that the region offered opportunities for full cargoes to Europe but not to North America on the return voyage. A return voyage, in ballast, to the starting-point is nearly equivalent to doubling the distance over which cargo is carried on the outward voyage.

The price at the port of shipment, with which we start in analysing competition in the coal-export market, varies with the internal conditions of the competitors—the United States and Great Britain.

Its essential elements are pit-mouth price and cost of transport and handling from mine to ship. The actual distribution of the exports to the various parts of the market depends not merely on these base factors, but in addition on the question of relative distances and economies of working from the point of view of the ship. Moreover, the importance of the element of distance varies with the relation of ocean freight rates to the laying-down price at the port of shipment. If freights are low, in proportion to this price, the protection afforded by distance diminishes. Looked at from this angle, the breadth of the Atlantic is far from being a fixed quantity, and, as we shall see later, even purely financial conditions may vary the amount of protection which it affords.

So much for the coal trade in bulk ; it represents, immediately, purchasing power ; we receive an equivalent return in goods ; indirectly, it is a seed sown which produces a valuable crop, valuable to us as well as to its owners. Northern Europe, for example, runs mainly on our coal and supplies us with that most necessary commodity—timber. Our coal, working the railways—largely British-owned—in Argentina, cheapens the supply of wheat, maize and meat for our use. Much of continental Europe, however, though depending on us for the main basis of its industry or commerce, is not in a position to supply us with foodstuffs or raw material in quantity. Is then this coal wasted for us, apart from its direct purchasing power ? The present crisis embodies the answer to this question. A prosperous Europe absorbs our manufactures in great quantity; without cheap coal its prosperity declines, and its general purchasing power is greatly curtailed. The policy of freely exporting our limited surplus for the benefit of Europe may have been wise or unwise; the sudden stoppage of the export could hardly fail to produce results disastrous alike for Europe and for us. The effect is the same whether such stoppage be the result of war, or of decreased output, or of excessively high prices. To Europe, the source of this coal is immaterial; it needs coal in quantity and at a reasonable price. The only possible sources are the three great fields, two of which in the past have been sufficient to meet all local needs. Their insufficiency, since the war, is one of the factors in the continued depression; the proof of this insufficiency, if proof be needed, is to be seen in the revolution in the Atlantic coal trade discussed below.

Exports of coal in bulk loom large to the view in official statistics; another form of export, that of coal for ships' bunkers in our ports, must not be overlooked. In 1913, no less than twenty-one million tons were thus shipped. Nor is this all: we must add the shipments to foreign coaling-stations and a considerable part of the shipments to commercial ports abroad, probably not far short of another twenty million tons in all. In other words, out of a total export from Great Britain in 1913 approaching a hundred million tons of coal in all shapes and for all purposes, some forty per cent. was for use in propelling the world's shipping and found its market for that purpose on the shores of the North Sea, the Mediterranean and the Atlantic. Over forty per cent. of the effective ocean steam shipping of the world at that time was owned in the United Kingdom and a very large part was carrying goods on our account.

We are thus interested financially not merely in the sale of the coal but in the indirect effect of the selling price, since this price is an important item in the cost of running a ship. In the case of some of our manufactured exports, the cost of transport may be a comparatively small part of the total delivery price to the buyer, and we may perhaps succeed in making the foreigner pay part at any rate of an increased cost due to a rise in the price of bunker coal; in the case of bulky imports, such as foodstuffs and raw materials, vital to our industries but only of moderate value in proportion to their bulk or weight, the cost of transport is usually a very considerable part of the delivery price which we ourselves must pay. A high price of bunker coal appears ultimately as a higher price of the raw material and foodstuffs needed by our industries and a consequent higher cost of production for our manufactures. A rise in the price of bunker coal is in effect a tax on the whole community for the benefit of the miners or coalowners, no less than a rise in the price of coal supplied directly to the home market for industrial use. Whatever the cause or justification may be, this is a fact and a vital fact in international trade.

The United States, with its great seaports at the other end of the Atlantic track, necessarily has a large bunkering business on the spot, but its exports to foreign coaling-ports were small in 1913 and confined for the most part to its own side of the Atlantic. On this side Great Britain possessed almost a monopoly. Even German agents, in foreign coaling-stations, commonly coaled German ships with British coal. The price of British bunker coal was thus a matter of surpassing interest to the whole of western Europe and more particularly to the industrial regions bordering on the North Sea and the Channel—the hub of the trade routes of the world.

CHAPTER III

The export of coal in bulk, as an item in international trade, or its sale for bunkers for the working of the ocean trade routes of the world, are facts of which the significance is forced on the most superficial observer; the indirect export, disguised in the price of a yard of cotton cloth or a piece of machinery, is less easy to track and liable to be overlooked. The coal factor in cost of production varies from industry to industry; but iron and steel are commonly accepted as indices to economic progress and in fact as the essential bases of any advanced national industrial economy. It so happens that in the case of iron the coal factor is most conspicuous, since it forms a definite and considerable element in cost of production or market price. An industrial system not based on native supplies of coal and iron is undoubtedly possible; but we are concerned here with existing facts. Up to the present, the main basis of development in the major industrial areas of the world has been found in the proximity of iron and coal and the consequent heavy iron manufacture. We shall, then, assume the continued importance of this primary process and consider from this standpoint the actual production of iron and steel just before the war.

In 1913, the United States produced over forty per cent. of the pig-iron of the world, or upwards of thirty million tons, as against about twenty million in Germany, ten in Great Britain and five in France. A historical comparison merely emphasizes the relative advantage of our competitors. Between 1900 and 1913, the output of the United States rose from fourteen to over thirty million, that of Germany from eight and a half to over nineteen, while Great Britain shows only a modest growth from nine to a little over ten million tons. Even France, with its small total production, registered a greater absolute gain in the period. For the working of the ore, Germany and France depended on the coal of the Rhine region, particularly that of the Ruhr field; while the American industry was based almost entirely on the eastern or Appalachian coal area discussed above. The output of steel in the United States, thirty-one million tons, was about equal to that of Germany, the United Kingdom and France together.

The production of iron depends on the juxtaposition of coal, iron ore and limestone, all bulky and costly to move. In the case of good fifty per cent. ore, half the weight moved is pure waste, since only half the content of the iron-stone is metallic iron. Therefore, the location of the ore in relation to the coal is of vital moment. About eighty-five per cent. of the ore mined in the United States comes from the area bordering on Lake

Superior. A short rail journey to the port of shipment, followed by a long voyage down the Lakes in specially built steamers, brings the ore to a group of receiving ports on the southern shore of Lake Erie. Here it may meet the coal railed from the eastern field or may itself be forwarded to the Pittsburg district, the original home of the iron industry. The Superior ores lie for the most part on or very near to the surface, particularly in the newly developed Mesabi range. They are quarried or dug out by mechanical shovels and handled throughout the journey to the furnaces by specially adapted machinery, and the whole process from ore to finished steel is coming more and more under the unified control of the great financial corporations. The result is the utmost economy of organization with a consequent lowering of cost. The ore for the most part is a hematite, with over fifty per cent. iron content and little phosphorus. The United States also imports similar ore from Cuba and a little even from Spain for the industry on the Atlantic coast where the coal again meets the ore; but the import is insignificant in comparison with the home production.

The industry of Germany, before the war, depended for its native ores mainly on German Lorraine, which provided twenty-one million tons out of a total of twenty-eight for the whole Empire. An important part of the balance came from the valleys of the Lahn and Sieg, east-bank tributaries of the Rhine. To this must be added the seven million tons raised in Luxemburg which belonged fiscally to Germany. The rest was imported from Sweden and Spain by sea and from the neighbouring area in France by rail. This area of France, the Briey district, with its "minette" phosphoric ores, was economically an integral part of the Lorraine-Luxemburg region. In the whole region, German coal was essential for the working of the ores; much coke from Westphalia was carried to the ore and much ore to the coal-field. The coal of the neighbouring Saar field produced only a coke of inferior quality for the purpose of iron smelting. The movement of ore and coal was partly national, partly international, though economically it was all part of a single organization.

If we add together the quantities of ore raised in Germany and Luxemburg, nearly thirty-six million tons, and in France, in the minette area, between nineteen and twenty million, and throw in four to five million for Austria-Hungary, we get a round total of sixty million tons as immediately dependent for exploitation on the coal supplies of central and western Continental Europe. This total, it may be noted, is approximately the output of the United States. Local supplies, however, were not sufficient. Sweden, Spain and countries of the Mediterranean seaboard produced between them another twenty million tons, of which seventeen million were surplus available for export. Of this about seven million reached the United Kingdom, while the remainder was absorbed by the continental coal areas, except for a small export to the United States from Sweden and Spain. Thus the iron industry of western

Continental Europe, measured by the total amount of ore consumed in 1913, seems to be rather larger than that of the United States, with its consumption of sixty-four and a half million tons of home and imported ores. Measured by the output of pig-iron, however, the two regions were more nearly equal, as the American ores on the average contain more iron. To the thirty million tons of pig produced in central and western Continental Europe must be added the ten million output of the United Kingdom, from twenty-four million tons of ore, two-thirds of which were native, together with the small production of Sweden, Spain and Italy, amounting in all to less than two million tons.

The above figures give a fuller meaning to the bare statement that in 1913 the United States produced over forty per cent. of the world's iron. The American industry is based firmly on native coal and ores and national transport, while the quality of the ores is rather better than that of the ores of Europe taken as a whole. A ton of ore in terms of iron, means rather more in the one case than in the other and statistics must be modified accordingly.

So much for conditions just before the war. What of the future? How far do reserves correspond to present output and what is likely to be the trend of costs in the chief producing areas? The problem is far less simple than that of coal owing to the existence of vast quantities of low grade ore widely distributed. In present circumstances these cannot be worked with profit; but methods may improve and circumstances may change. Much of the reserve has not been surveyed adequately, and the estimates are less to be trusted than those of coal; none the less, they are sufficient to provide a fairly reasonable indication of the future.

American geologists estimate the potential supplies of Lake Superior ores of fifty per cent. iron content and upwards at a round seventy-five thousand million tons. Here is provision for well over a thousand years. Of lower grade ores, but still over thirty-five per cent., there may be four or five times this quantity. In other words, the total iron ore of this region provides supplies for three to four thousand years at least, at present rates of consumption, and will far outlast the coal. There are also vast deposits of ore in Canada, not available under present conditions of production and marketing. North America, it is clear, need have no anxiety as to the future of her iron supply, in so far as quantity is concerned. Europe suffers greatly in comparison. The Lorraine district contains perhaps seven thousand million tons, or a tenth of the higher grade resources of Lake Superior. Its exhaustion is a matter of only two or three centuries. On the other hand, the United Kingdom is credited with reserves of ore amounting to upwards of forty thousand million tons. At first sight we seem to be in the same class as the United States, but the figures are grossly misleading. At least three-quarters of the whole, mainly the ores in the carboniferous measures, are not likely to be worked on a grand scale under any conditions which can be foreseen to-day, while most of the remainder is well below the fifty per cent. standard. Our reserves of really high grade ore are a negligible fraction of the world supplies. The native production was considerably less in 1913 than in 1880, while the increased consumption was met by larger imports, particularly of hematites from northern Spain. These, in turn, are within sight of exhaustion, while Sweden, too, is feeling the need of conserving her resources by the restriction of exports.

The report of the Geological Congress of 1910 assigns to all Europe actual and potential supplies of over fifty thousand million tons of workable ore, containing some seventeen thousand million tons of metallic iron. The amount raised annually in the whole of Europe on a pre-war basis was rather over a hundred million tons, so that there is no immediate prospect of exhaustion any more than in the case of coal. It is, however, the most easily worked and richest deposits which first show signs of exhaustion. Such signs are visible to-day in Europe, and more particularly in the United Kingdom, in the form of rising costs of production. Once again we must remember that production and marketing of iron take place in a world of competition ; and cheap iron is essential for industrial progress. The cost of the coal, the cost of the ore, and the cost of bringing the two together, with the labour and additional material necessary for the actual process of manufacture, are the essential factors in the market price of iron.

In 1913 the cost of good hematite, that is fifty to fifty-five per cent. ore, in the Superior district, was estimated at an average of 9*s*. per ton, while the selling price at Lake Erie ports ranged from 14*s*. to 16*s*., according to quality. The difference of some 6*s*. represented the cost of rail to an upper Lake port, together with loading and carriage for over eight hundred miles by Lake steamer. If the ore were forwarded inland to Pittsburg, the price would be raised by 4*s*. to 5*s*. When the ore became pig, its average price in the Pittsburg market was 71*s*. How does this compare with conditions of production in the United Kingdom over the same period? The average value of Cleveland iron-stone at the mines was 5*s*. per ton and rising. Year by year the winning of the ore becomes for physical reasons more costly as the better parts of the seams approach exhaustion. The iron content is only some thirty per cent., so that the real cost of production is not greatly different from that of the American ores. On the other hand, the ore lies close to the coking coals of Durham, while the American ore and coal are widely separated.

A closer parallel is to be found in the imported Spanish ore, the best Bilbao being on a fifty per cent. basis. The average price of this ore delivered at Middlesbrough was about 21*s*., of which a quarter represented the freight rate from Spain. This compares with 15*s*. at Lake Erie ports; but the rail freight to Pittsburg increases the delivery price at the furnaces to about 20*s*. The average price of east coast hematite pig was 73*s*., and of west coast hematite 69*s*. 6*d*.; though prices fluctuated greatly through speculation. The broad result was production in England and America at approximately the same levels of cost ; but we must not forget that Pittsburg is a long way from the sea, and is thus handicapped, as compared with Middlesbrough, in exporting its products. If the Pennsylvania coal-mines, with their low pit-mouth prices, had been close to the shores of Lake Erie, as the Durham mines are close to Middlesbrough and the sea, results as measured by local prices would have been distinctly in favour of the United States.

CHAPTER IV

In dealing with the war period our chief difficulty is to distinguish temporary from permanent effects. The former are already becoming a matter for the historian; the latter are of supreme interest to-day and in the future. We have not settled down to conditions of peace, yet there are some indications of the lines on which settlement is being slowly attained. Coal, in particular, offers a knotty problem, owing to the recent removal of official control and to the fact that readjustment is still in progress.

Production in the United States, after a temporary drop in 1914, increased steadily from 510,000,000 tons in 1913 to over 600,000,000 in 1918; in this year, too, the production per person employed reached a maximum. The next year was affected by strikes; but in 1920 production recovered and reached 575,000,000 tons. The increase was in bituminous coal only; anthracite production remained on the whole steady. Here then is a measure of the effect of war on the coal industry in the United States: it provided a stimulus and a growing market either internal or external.

How does the record of the United Kingdom compare with this? The output of 1913, nearly 290,000,000 tons, was the high-water mark of our production. From this point the output fell to 229,000,000 tons in 1919, and remained at that low level in 1920. At the same time, the output per person employed declined from about 260 tons in 1913 to about 190 tons in 1920. A greatly increased number of workers produced less, not only per head but also collectively. The full economic significance of this comparison is not evident in the figures. Coal for internal industry and coal for export perform widely different functions, and it is essential to inquire into the distribution of the American increase and the British decrease.

The American increase was mainly for the home market. Less than a quarter of the increase was destined for export, and the total exported barely reached 35,000,000 tons as compared with 20,000,000 in 1913. This is but a small portion of the total produced and of this fraction a considerable part found its usual market in Canada. The remainder, about 20,000,000 tons, was shipped from the ports of the Atlantic seaboard, particularly Hampton Roads. It is this twenty million tons of bituminous coal which makes a direct impression on the world market and competes with the British surplus, the only other surplus available in any quantity during 1920. Nearly fourteen million tons of bituminous coal crossed the Atlantic, mainly to Europe, and three and a half million to South America. This contrasts with a few hundred thousand tons to each destination in 1913. Here is evidently a very important fact, a fact demanding investigation and explanation. Is it merely a survival of abnormal war conditions or is it to be regarded as a permanent element in the future organization of trade?

Let us consider more closely the destination of the coal. France, Italy, Holland and Scandinavia were the chief markets; while even Switzerland and Egypt took each more American coal than the whole of Europe in 1913. With the exception of Holland and Switzerland, these are the countries which before the war depended largely on British coal. The same applies to South America; British coal, in 1913, was shipped largely to the River Plate and Brazil, and on a smaller scale to Chile. The explanation of the substitution is to be looked for in the conditions of the export trade of Great Britain.

The drop of sixty million tons in production represented two-thirds of the surplus available for export or bunkers in 1913. Home industry and foreign trade were competing for the same supplies, and the maintenance of the one necessarily involved the decline of the other. The consequence is written clearly in the export figures. In 1920, exports in bulk dropped to just below 25,000,000 tons, and bunker coal to below 14,000,000. In 1913 the corresponding quantities were 73,500,000 and 21,000,000.

The distribution of the coal exported is significant. As compared with 1913, the shipments to France showed a fall of only 1,000,000 tons; to Scandinavia the fall was 6,700,000; to Italy, 6,700,000; to Russia, Austria and Germany together nearly

16,000,000. All other European countries showed similar decreases. The German surplus, owing to decreased production, no longer existed; more than could be spared from the home market was earmarked by treaty for special countries. It needs little effort of the imagination to visualize the effect of this great deficit on the industrial economy of Europe and to appreciate the pressing need for alternative supplies. South America suffered in like manner; in place of some 7,000,000 tons, Brazil, the River Plate and Chile received together only 500,000 tons of British coal. Of this total, less than 10,000 is credited to Chile, as compared with 590,000 in 1913.

In normal circumstances, the distribution of coal is determined by price; but the above system was largely arbitrary and based on rationing either in the interests of our own industries or of our allies. We have now reverted to the normal and therefore price again becomes the pivot of the industry. The exports of 1920, in quantity about a third of the exports of 1913, were in value at the moment of shipment approximately double; that is coal for export had increased six times in price. The price to the buyer in foreign countries was raised still higher as compared with that of 1913 by the excessive cost of freight. An exceptional temporary price for exports allowed of a price for home use below cost of production. In a free and well-organized market, however, there cannot be two prices for the same thing at the same time. For the moment we made the foreigner pay; we enjoyed a partial monopoly of supply owing to the disorganization of transport, the absence of German competition and the fact that America in the past had not developed a mechanism for export on a large scale. Yet we have no real monopoly of coal production and cannot permanently subsidize home industries at the expense of the foreigner, allied or otherwise. Our advantage is only temporary; it is limited, until Germany recovers, by the cost of laying down foreign coal, in the necessary quantity, in Europe. This, in turn, depends on cost of production in surplus areas together with cost of transport to the European markets. If price favours such trade, the necessary mechanism can soon be devised. How great will be the deficit on the Continent in the near future depends on the extent to which production is re-created in the German mining areas. In 1920 the only other effective surplus area was in the eastern United States. The existing mines there have already proved their capacity, after providing for home industry, to produce a surplus sufficient to supply the needs of Continental Europe, as evidenced under the normal conditions of 1913. How far this is likely to be done is a question of policy as well as price. Policy is beyond forecast, so we will return to the problem of cost of production as an element in price.

The war sent up costs in America as in Europe, but not in the same proportion. An official investigation into mine costs, in the summer of 1920, based on a comparison of a large number of mines, resulted in an estimate of from two to three and a half dollars per ton as the actual pit-mouth cost. The corresponding laying-down price at the seaboard would be from five to six and a half dollars. In view of the methods of the private producer in dealing with government departments, it is not in the least surprising that for this coal the American navy was charged as much as eighteen dollars. Such charge has of course no relation to commercial costs or prices.

A surer basis for comparison is to be found in March, 1921, when the coal industry on both sides of the Atlantic was unremunerative and owners were pressing for reduction in wages bills. In the latter part of that month, pit-mouth prices for New River and Pocahontas coals were between three and four dollars a ton, and the best quality coals were selling on pier at Hampton Roads at six to seven dollars. Here we are getting back to some correspondence between actual market prices and costs of production as estimated by the Federal officials in 1920. Some Pittsburg coal was actually selling at two to two and a half dollars at mine, but many mines were idle and operators maintained that this was below the actual cost of production. In fact, Virginia mines were closing down in preference to paying the agreed wages, while miners in non-union mines elsewhere were accepting a thirty-three per cent. reduction. In the boom of the summer of 1920, this same coal sold in the interior at ten to twelve dollars per ton. We are clearly somewhere near rock bottom in March, since cost of production can only be lowered by means of a heavy cut in wages. The remunerative pit-mouth price in the eastern coal area of the United States seems to have rather more than doubled as compared with that of 1913, the rise being mainly due to increased labour costs. The price for coal for export has risen to the same degree approximately. Export, however, is for a competitive market, and in considering this later we shall find it necessary to take into account the rate of exchange between the United States and the countries of Europe, including the United Kingdom.

The coal business of Great Britain, in March, 1921, can hardly be said to have settled down, but like that of the United States it had reached an unremunerative level as measured by the relation of prices and costs. The two industries, therefore, are roughly comparable. The pit-mouth costs, already higher in 1913 than those of America, rose steadily throughout the war, until in the summer of 1920 they were 34*s.* per ton, of which 26*s.* was on account of labour. In South Wales, one of the chief exporting areas, costs were considerably above this average for the whole kingdom. Costs still rose in the last three months of the year. In December they reached 40*s.* and remained near this level in the first quarter of 1921; while costs in South Wales exceeded 57*s.* Over seventy per cent. of the cost was on account of labour. We may say broadly that while American costs doubled, British costs quadrupled as compared with 1913. The change is reflected in the price of exported coal at the Welsh seaboard. Instead of 18*s.* to 19*s.* for best ordinary steam coals, we find quotations of 110*s.* during the summer and 75*s.* to 80*s.* at the close of the year when the imports of American and German coal satisfied the French market which refused any longer to pay us "fancy" prices. The slump from artificial monopoly conditions was inevitable. How far did it go? Towards the end of March the Cardiff price was still round 52*s.* for export coal. Let us compare the selling conditions of British and American coal at that period in Italy, one of our chief markets before the war. With a freight rate to Genoa of 15*s.* 6*d.*, said to be unremunerative, the landing price there becomes 67*s.* 6*d.* or two and a half times the price of 1913. Allowing a price of six and a half to seven dollars for delivery at Hampton Roads of American best coal and another five and a half dollars for freight, also unremunerative, we get a delivery price in dollars of a little less than twice that of 1913, or 50*s.* to 52*s.*, if the dollar be converted into sterling at par. Under such conditions it may seem that American coal could be sold even in our own ports in competition with native coal. At the current rate of exchange for sterling, however, the price in Genoa would be from 61*s.* 6*d.* to 64*s.*; or converting both currencies to lire we arrive at a delivery price of about 334 lire for Welsh and 302 to 314 for American coal. On either basis of calculation, American coal is still the cheaper, but the distance between the two prices is much less than that suggested by the uncorrected figures. Allowance for the inferior quality of American coal may decrease this difference still further.

If we consider a market where exchange rates are more normal we find similar conditions marked. Cardiff coal was forwarded to the River Plate and delivered at about 70*s*. per ton. The price for American coal, with freight at six dollars, works out at 52*s*. to 54*s*. sterling at par rate and at 64*s*. to 66*s*. 6*d*. at current rate of exchange; while the conversion of both currencies to pesos gives a difference in favour of American coal of 1 to 1·7 pesos gold. We were undersold in this market also. If this process continues in more normal times, among other consequences the freight rate on grain from Argentina to Europe is likely to be permanently higher. There is a further point to be noted. The depreciation of European currencies in relation to the dollar acts generally as a restriction on American export trade to Europe. It may be desirable to restore the exchange value of the pound sterling for dollars, but as is clear from the figures above this is equivalent to lowering the delivery price of American goods as measured in pounds and shillings. It seems that the result would be a further impetus to American coal exports to Europe or to the Atlantic coaling-stations, and that we should be brought within measurable distance of the actual import of American coal for our industries. This argument, however, involves the assumption that coal prices in the United Kingdom do not fall as the American exchange improves. This is possible under an artificial system of state control of wages, and an interesting speculation is provided as to the attitude of the politician faced by a demand on the part of the miners for protection of their standard of living by the imposition of a duty on imported coal!

It is clear that under the conditions indicated above American coal can compete effectively not only in Europe but in all other markets which buy our coal in bulk. We are protected temporarily by the exchanges which handicap American exports just as they assist for the moment those of Germany. Protection is also afforded by freight rates, but this is a decreasing quantity with the return to normal conditions. It must be remembered also that economy in production costs is possible no less for the United States than for ourselves, and that in their case the labour cost is a smaller factor in the total. Machinery is used in the production of more than half of their bituminous coal, in less than fifteen per cent. of ours. There is, for the moment, a limit to the capacity of their export organization, but only for the moment. Means of transport are easily created in America, and there is a distinct disposition to make long contracts ahead for export. How far the United States would permit the permanent development of a huge export to Europe depends to some extent on policy. Policy may dictate the conservation of her supplies of cheap coal rather than their rapid exploitation for the benefit of Europe. The exhaustion of American oil resources stands as a warning. In other markets, in which the United States is specially interested, notably South America, or in cases where the coal trade is of direct benefit to her shipping, she will doubtless attempt to maintain the position reached under the abnormal conditions of the last few years. Whatever may be the tendency of the direct export trade, her lower cost of production of coal will be felt indirectly, but none the less strongly, by her European competitors, in those industries in which coal is an important factor in the cost of production; and it will be felt in all the markets of the world. Her export of coal, even if sufficient to displace entirely that of Great Britain, would amount only to some twelve per cent. of her total production in 1920. It is the vast quantity retained at home as the basis of manufacture, and backed by the capital accumulated during the war, with which manufacturers in the other coal areas of the world must reckon in the future.

We have noted above the comparative conditions of production of certain types of iron in the United States and the United Kingdom before the war. Conditions during the war may be ignored. Production, not price, was the sole consideration, as the taxpayer knows to his cost. Now, and in the future, price regains its former position of control. To this condition we must adapt our organization; the alternative is bankruptcy and national ruin. World prices defy the muddled efforts and high-sounding decrees of governments, whether democratic or autocratic. Iron prices in the States are up, like all others; but to what extent? The delivery price of the best ore at Lake Erie ports in 1913 was just over four dollars; in 1920 it reached seven and a quarter. The resulting price of Bessemer pig-iron in 1913 was seventeen dollars, or about *71s.*

if the dollar is converted to sterling at par. At the end of 1920, the Pittsburg price of Bessemer iron was around thirty-four dollars. At par this is equivalent to about 142*s*. but at the then current rate of exchange it would be represented by about 194*s*. sterling. American costs of production of iron in dollars in 1920 were thus doubled as compared with 1913; how does this compare with results in the United Kingdom? Prices before the war, as we noted above, fluctuated around approximately equal levels in the two countries.

First let us consider the supply of raw material. We have noted already the rise in the price of coal, though it must be remembered that British prices for home industry in 1920 were not related economically to costs of production owing to the artificial system of price control. Home industry was subsidized at the expense of foreign trade. What of the ore? Mine prices of Cleveland ironstone had trebled, from 5*s*. in 1913 to 15*s*. in 1920; while the price of the best Spanish imported ore was 50*s*. as against 20*s*. in 1913. The increase in raw material costs is clearly higher all round than in the United States. The increased cost was operative at all stages of production, and the final product shows a wide price difference between the two countries. Hematite prices on the east coast were over 250*s*. at the end of the year, that is the increase on 1913 was nearly three and a half times.

On the basis of local costs of production, it seems that the United States ought to be able to deliver iron at Middlesbrough and undersell the local product. Two facts prevented this ; the cost of freight, which was high but declining, and the effect of the adverse exchange. Corrected for the rate of exchange, the price difference in the two markets was between 50*s*. and 60*s*. per ton, and this at the time was hardly sufficient to cover the cost of freight from Pittsburg to the coast and across the Atlantic. With the pound sterling at par with the dollar, the difference would be over 100*s*. and the British product could easily be undersold in the British market itself. Here is a rough measure of the protection afforded in 1920 by the adverse rate of exchange ; but the vital fact remains that costs had risen far less in the States than in this country. It is not so much the actual rise here which mattered, as the difference in the rate of rise in the two countries. Before the war these were competing on approximately level terms ; in 1920 the United States had an advantage in the production of raw iron and steel which threatened our position in all the world markets which consume steel products.

It is true that economies are possible by better organization, particularly in the more scientific use of coal ; but economies are equally open to our competitors whether in America or in Europe ; we have no monopoly of efficiency. Whether we are dealing with iron, or with bulky raw materials and foodstuffs, we find that coal is one of the most important elements in the price ; it is also essential to the prosperity of our important Continental markets. America has shown a capacity for tackling the trade in bulk if she wishes, and she undoubtedly intends to continue her inroad in the foreign markets for our manufactures. In these she will exploit to the full the advantage of her relatively cheap coal, an advantage which has grown steadily during the war period.

A very large percentage of the increased cost in the United Kingdom is due to higher money wages and reduced output per unit of labour. When so much of the total cost of output is represented by the payment of labour, any economies on the remaining items, just or otherwise, can produce only a relatively small effect on the market price of the coal. Any considerable reduction in market price must involve a readjustment of wages to output, if the coal is to sell in a competitive market. We may abolish our export business in coal with certain ill-effects, direct or indirect, to ourselves ; we may reduce costs by closing down the mines unprofitable in present circumstances. There remains still the home market ; but much of the activity of this market is with a view to exporting its products. An inordinately high price for its coal means higher cost of production for the goods which must compete in the world market. Costs may be reduced by "economies" ; but economies are equally possible to the foreigner. In the last resort either trade disappears or profits and wages must fall in the industries using coal in any quantity. If the price of coal is fixed above world levels to maintain the standard of the miner or the profits of the mine-owner either the mines must close or some one must pay a subsidy, and that some one is likely to be the wage-earner in other trades.

In the absence of a protective duty on imported coal, there is a limit to the price to which coal can be forced even in the home market. That limit is reached when foreign coal can be sold in Newcastle or Cardiff at the same price as native coal. For the only possible source of foreign coal we must look to the other side of the Atlantic, since we can hardly regard supplies from South Africa, Australia or China as a permanent basis for European industry. The fact that a large movement has been possible, even temporarily, from the American field is a measure of the changed positions of the two coal areas. If prices are such that it pays our industries to buy American coal, it is clear that they are penalized in competition with American users on the spot to the extent of the cost of three hundred and fifty to four hundred miles of rail transport and three thousand miles by sea. We were not far from this position in 1920; if coal had remained at its then cost some of our industries, temporarily in abeyance, would have vanished for ever from the map of our activities. Great Britain cannot exist without a large overseas trade; if our exports fall
1952 off, while our population increases, we must emigrate or starve. Our exports depend on competitive prices; the outside world is not ruled by sentiment; it recognizes no "right to work," no "standard of living," no moral conditions; it buys in the cheapest market, regardless of the elements which constitute the market price. This is simple fact and is not

likely to be altered until we have effective federation of the world, and this, at the moment, is hardly within the ken of practical politics.

The year 1920 may be regarded as an episode, but also as a warning. The coal war of 1921 forbids any attempt at comparisons for that year; yet a few facts are worth brief notice. American production declined to about 440,000,000 tons, that is less than in 1913. The overseas export also declined, but not in the same proportion. It was still not far short of 9,000,000 tons, or a little more than in 1919, while over three-quarters found a market in Europe. The chief buyers were Italy and the United Kingdom! But for the strike, much of this coal would not have crossed the Atlantic. It was largely moved or purchased in the earlier part of the year, and the autumn months witnessed the gradual disappearance of American cargoes from this side.

In the whole year, 1921, in spite of the strike and an import of three and a half million tons, the British export was nearly twenty-five million—about the same as in 1920, though at less than half the average price per ton. The recovery came towards the end of the year. Though the total export to France was halved, the rate in December if continued would give a total as high as that of 1913; while the export to the River Plate in that month alone was two-thirds of the total for the year 1920. America became alarmed at the reappearance of our coal in the markets of the West Atlantic, and proposals were made for a reduction in railway rates on coal for export to meet this new competition. Conditions on this side, however, were far from satisfactory. The miners complained that they were not making a living wage, and the owners that they were running at a loss, while home industry was still penalized by the excessive price of industrial coal. There was evidently no permanent adjustment between wages, output and prices.

Whatever was the cause of this lack of adjustment, the prices themselves illustrate sufficiently the conditions necessary for effective competition with America. The price of Welsh coal for export dropped to about 25*s*. at the end, as compared with over 80*s*. at the beginning of the year. Freights to Italy ranged from 12*s*. to 13*s*. On the other hand, American coal at Hampton Roads was five dollars or less, and with freights at 3·75 to 4·00 dollars, the delivery price in Italy would be 40*s*. to 42*s*. 6*d*. at current rate of exchange for sterling. Expressed in lire, the prices would be 180 to 185 for Welsh and over 200 for American, at the rates ruling at the very end of the year. As a matter of fact, during the greater part of the month, quotations at Genoa for American coal were somewhat lower than for British; but we may say that by the end of the year a position of equality in competition had been reached once again. None the less, the price of American coal, with the dollar converted at par, would have been 35*s*. 6*d*. to 37*s*. 6*d*.; and, in view of the steady appreciation of the pound sterling in terms of the dollar, there seems to be little room in this market for any rise in the price of British coal.

In South America, conditions were rather less favourable to us since freights were higher from Cardiff and lower from Hampton Roads; but even here there was a rapid fall in the American trade during the last few weeks of the year.

What of the iron trade and the indirect effects of the high price or the lack of coal? In 1921, the price of Spanish ore was slowly approaching pre-war levels; by the close of the year it had fallen to 26*s*. to 27*s*. East Coast hematite was then about 100*s*. and Pittsburg Bessemer at the dollar equivalent of 116*s*. America could not reach our markets under such conditions, and for the heavy import of pig-iron rendered necessary by the stoppage of our furnaces we depended on Belgium and other European sources—a reminder that if our costs of production remain too high there are competitors to be reckoned with on this side also of the Atlantic.

It may seem that 1920 and 1921 were parts of a nightmare and that American competition is a thing of the past. Yet markets are being recovered only by heavy sacrifices, and no basic industry can be pursued at a loss for any length of time. Conditions can hardly be deemed stable internally so long as the miner fails to earn a decent wage, and the mineowner secures no profit, while the export price of pig is less than the cost of production. Unless the cost per unit of output falls, either trade must cease or the selling price must rise; but we are still not far from the level at which American competition may again become effective. The events of 1920 showed us that competition in its most direct form;

the indirect results in the sphere of manufactures are more difficult to detect. We may, perhaps, realize gradually, in the competition for world markets, the effect of the handicap which we have imposed deliberately on ourselves. Trade once lost is not always easy to regain. In this respect, the excessive prices of 1920 may have inflicted almost as much damage as the stoppage of production in 1921. Prohibitive prices, or a total refusal to sell, are calculated to produce similar results in the market ; and in a country depending for its economic existence largely on exports, an absence of foreign buyers is followed inevitably by lack of employment in industry. In international trade the buyer, not the seller, usually calls the tune.

APPENDIX

WATER-POWER AND OIL

THE high price of coal is not entirely an evil if it leads to more serious consideration of the question of waste and the better utilization of the theoretical energy contained in various forms in the coal. Such improvements, however, are not the monopoly of this or any other country, and therefore do not affect the problem of international competition based on coal except in so far as one country progresses more rapidly than another in the path of reform. A more immediate result of high prices, temporary shortage, and the uncertainty produced by strikes, actual or threatened, is to be found in the rapid growth of interest in the two sources of mechanical power which may be used to supplement or displace coal, that is water and oil. The distribution and possible development of these sources is a matter for the careful consideration of the producers of coal. Every rise in the price of coal puts a further premium on the exploitation of substitutes.

The relations of these two competitors to coal differ greatly, since oil can be transported with even greater facility than coal, while the distribution of water-power is only possible commercially over comparatively short distances. Thus the exact location within a country of this source of power is more important than that of coal, as the location defines the limits of its influence both in industry and transport.

At the outset we meet a most serious obstacle. It has been noted that the geological estimates of the reserves of coal available are very far from representing the actual quantities of coal which are likely to be brought to the surface; in the case of estimates of water-power, the theoretical horse-power available, based on the quantity and fall of the water in an area, is so far removed from the commercially convertible power as to be of little or no value. Statistics which profess to give available horse-power per annum yet ignore for instance the complete stoppage by ice of the source of supply merit a title somewhat stronger than "misleading." A useful method of treatment, founded on practical experience, is to divide the original engineer's estimate by two in order to obtain a mere preliminary basis for consideration as a commercial proposition.

Effective water-power is the combined result of rainfall and strongly marked relief, and regions in which these two elements are conveniently combined are not necessarily regions fitted in other ways to support a dense industrial population. Thus the Pacific region of the United States is only a small part of the total drainage area but contains some thirty per cent. of the total theoretical water-power. Water has not been investigated with the same care and accuracy as coal, but the actually developed powers give some indication of future prospects, while the contrasts between countries are so great that wide errors in the estimates would make little difference to the final result.

Let us make, as a preliminary, a rough comparison. An official estimate for the United States in 1912 gives a maximum of over sixty million horse-power and a minimum of over thirty million. This is based on an assumed efficiency of the converting turbines of ninety per cent. The actual conversion is nearer seventy-five, and the maximum and minimum are reduced accordingly. If we take twenty-five to thirty million as commercially possible in the future we may be somewhere near the reality. Of the total theoretically available, over seventy per cent. is to be found in the States of the Rockies and the West, California, Washington and Oregon accounting for forty per cent. The remainder is scattered along the Appalachians, in New England, and in the country bordering on the Great Lakes. It will be sufficiently accurate if we consider a fifth to a quarter of the available supply of the States as belonging to the same industrial region as the two great eastern coalfields. From the centres within that area, the power can be transmitted, normally and on a commercial basis, over a radius of two hundred miles or a little more. Before the war, the United States were already utilizing six million horse-power for all purposes, while another two million was in process of development. Two-thirds of the total power developed for manufacture was in New York State and New England, mainly for paper, pulp and cotton ; while much of the remainder was in the western Lake district, for paper and pulp. The total horse-power used in the United States was estimated at thirty million, so that twenty per cent. from water was a very considerable fraction of the whole.

The calculated saving of coal, however, on the basis of a twelve-hour day, was only about thirty million tons, while the total production of coal was in the neighbourhood of five hundred million tons. The saving becomes greater in proportion as the efficiency in the utilization of coal decreases, and this efficiency is probably taken at too high a figure. It is enough for our purpose to consider the permanent coal equivalent of this developed water-power of the States as between thirty and forty million tons per year. As a useful standard it is worth remembering that the theoretical horse-power of Niagara is something over six million, or the equivalent of at least thirty million tons of coal on the above estimate. Only a quarter of this, however, can be utilized under treaty, while the share of the United States is only half a million horse-power.

Let us now turn our attention to the other side of the political boundary. Canada, on a recent estimate, shows a development of about two and a half million horse-power. Of this, eighty per cent. is in Ontario and Quebec and the remainder mostly in British Columbia.

It is difficult to get any clear view of the possibilities of Canada. Evidently the most vital area is that of Ontario and Quebec, which is now largely dependent on imported coal. Omitting the rivers flowing into Hudson Bay and the Arctic, and making rather drastic reductions in official estimates we may assume an additional three to four million horse-power at least as likely to be commercially available in this region in a reasonably near future. This is more than the equivalent of the present import of coal from the United States, though it must be remembered that much of this coal is for domestic heating. Another three or four millions may be assigned to British Columbia, Alberta and the Winnipeg region, all within easy reach of the existing belt of population. The rivers flowing into the Arctic and Hudson Bay, and those of Labrador doubtless represent enormous stores of energy, but their utilization seems somewhat outside practical economics. It is clear, however, on the most conservative estimate, that North America as a whole has effective reserves of water-power equivalent to the saving of a hundred to a hundred and fifty million tons of coal per year on the present extravagant basis of coal consumption. Even this vast weight is not very much more than the surplus over home consumption which can be produced by the full working of the existing mines in the United States; while that large portion of the water-power which lies in the far west can have little effect on the fortunes of the manufacturing east, which is the chief region of interest to European competitors.

There are scattered sources of water energy in many other parts of the world, but only those of Europe are of real importance in relation to the supply of coal for manufacture or transport. Estimates of the available horse-power in European countries vary greatly. The two dominant areas are the Alps and the heights of Scandinavia. In Central Europe, in 1914, one estimate gives about six million each to Austria and France, three million to northern Italy, two million to Switzerland, and only a million and a half to Germany. Other estimates put the Swiss supply at a much higher figure. Here we have the nominal equivalent of three Niagaras, and a large part of this depends on the Alpine drainage. On the basis of division by two, this suggests a commercially available supply for Central Europe of something under ten million horse-power, or the equivalent of over fifty million tons of coal on the basis of conversion adopted above. This would cover the normal, pre-war deficit of France, Italy, Switzerland and Austria. Italy, on the same method of treatment, may perhaps be credited with a further million horse-power in the Apennines. It must, however, be remembered that power transmitted electrically is not an effective substitute for coal in every form of manufacture, and that in the case of France and Austria much of the power is remote from the most active industrial areas.

Norway and Sweden claim six to seven million horse-power each, Finland three million and Spain five to six million, giving a total commercially possible supply on the margins of Europe roughly equivalent to that of the Alpine region. Last of all comes the United Kingdom with less than a million, and that scattered about in small units in the least accessible districts of the west and north. The whole of Central and Western Europe together, on a conservative calculation, has over twenty million horse-power, or the equivalent of at least a hundred million tons of coal. The above figures are reached by a somewhat drastic treatment of the estimates put forward by the various countries concerned. Such treatment seems to be amply justified both by American experience and by physical and economic considerations. The theoretical maximum power in a region is never available as a matter of actual mechanics, while much that is so available is never likely to be converted owing to the cost in relation to that of coal.

The whole problem is affected by considerations of climate and position. We have seen, in the case of the United States, the element of distance restricting the area of distribution of power based on water, and the drawback involved in the location of so much of the power in the west. In Europe, population is densest in the west, where much of the water-power lies. This is an obvious advantage. In both continents, however, the competition of water with coal is dependent to a high degree on the problem of regularity of supply. In this connexion the oft-quoted Niagara is a dangerous guide.

Niagara, owing largely to the natural storage reservoirs provided by the Great Lakes, is one of the most regular of rivers, its maximum flow being less than forty per cent. above its minimum, while the difference on the St. Lawrence is only about double this. The seasonal variations of most rivers are far greater. On the Ottawa, flood rises to fifteen times the minimum ; on the Hudson to a hundred times, and on the Delaware to nearly four hundred times. Either the greater part of this potential energy must run to waste or reservoirs must be provided at vast cost and the economic advantage over coal tends to disappear. Drought, frost and irregular rainfall combine to render the flow of water in most rivers so variable that the costs in a favoured position such as Niagara are no criterion whatever.

If machinery is only adapted to take the minimum flow available throughout the year, there is inevitably colossal waste of energy, measured by the difference between the maximum and minimum flow ; if machinery is built to utilize the maximum, then a considerable part must stand idle for all but a few weeks in the year. The alternative is storage on a grand and costly scale such as is provided by nature in the Great Lakes. It is easy in the light of such consideration to understand why water-power has developed most successfully either at sources specially favoured, such as Niagara, or in regions far removed from the effective competition of coal. Once more, as in the case of coal from two possibly competing areas, it is a question of cost of production and market price. It is also a question of the location of the market ; the demand for traction and lighting is widely spread ; that for manufacture is mainly in the areas of dense population which in turn owe their existence largely to the presence of cheap coal.

The cost per annum of one horse-power produced at Niagara is said to be only a half to two-thirds the cost of one horse-power produced by steam with the largest and most modern installation. The price, however, rises rapidly with distance from the source of supply owing to the cost of transmission. Even where coal and water are on terms of equality, that is both in the same district, and with normal types of rivers as in the Appalachian area, American experience seems to show that it is often cheaper to mine the coal than to exploit the water. In California, on the contrary, power is sold commercially at twice to four times its price in the eastern states, partly owing to long-distance transmission, partly owing to the absence of effective competition from coal.

The same considerations apply to Europe. The water-powers happen to be in the regions lacking in coal and often at a long distance from coal. Under pre-war conditions, the development of local water-powers was held in check by the low delivery price of British coal ; its continued high price would put a premium on such development. The countries concerned must have cheap mechanical power, and they will be only too glad, from the national point of view, to take the opportunity of rendering themselves as far as possible independent in this essential respect. Even a partial development of the resources available would go far towards satisfying the Continental demand for imported coal, whether British or American.

Western Continental Europe, the Europe of industry and trade, seems to be rather better off than eastern North America in respect of accessible water-power, and this fact may perhaps offset somewhat its inferiority in reserves of coal. In the United Kingdom, however, water is negligible in relation to coal and coal must remain the basis of industry and transport. The only great source of energy on the surface is to be found in the tides. In theory, this is colossal; in practice, and economically, its utilization is only possible at a few favoured spots on our coasts, and even here the estimate of the resultant price must be largely founded on guesswork, while the quantity of power produced is not likely to make much impression on the position of coal in our national economy.

There remains oil. Of this we have no stores worth mention, and no effective production, yet enthusiasts and promoters of companies assert that for transport at any rate here is the rival to whom coal must give way in the future.

In dealing with the question of the supply of oil for the needs of the world we are confronted with two main difficulties. In the first place the problem is new; consumption in recent years has increased so rapidly that it is not easy to estimate its expansion even in the near future; in the second place the amount of the commercial reserves in the world is a matter of the merest guesswork in the present state of our knowledge. Let us begin then with definite facts and work from the basis of world conditions just before the war.

In 1913 the world production of crude oil was rather over fifty million tons. Of this total, nearly two-thirds belonged to the United States and one-sixth to Russia. Mexico came third with some six per cent., while the Dutch Indies and Burma together produced a little less than Mexico. The remaining sources in this year are clearly not worth consideration from the point of view of world economy. As the growth of the oil industry has been so rapid, a brief glance at its history is necessary. In 1873 the marketed production of the world was less than a million and a half tons, of which ninety-five per cent. was credited to the United States and the remainder to Russia. Ten years later the total was a little under four million tons and the Russian share had risen to twenty per cent. Production was accelerating rapidly. By 1893 it amounted to over twelve million. Of this the United States accounted for about fifty-two per cent. Russia for forty-three; while the Dutch Indies and Burma appear now with a modest share of a little over one per cent.

By 1903 production had doubled again on this large total. Out of twenty-six million tons, the United States produced just over fifty per cent. and Russia rather less than forty per cent., while the Dutch Indies and Burma together gave a little over four per cent. At the beginning of the century America and Russia still dominate the world, but Russia shows a slight relative loss on the increased total production. In 1904 Mexican oil began to appear on the market. By 1913 the world output had again doubled approximately, but the Russian share had declined to less than seventeen per cent. Mexico had grown rapidly from nothing until it surpassed the East Indian total, while the United States controlled the world market. The remainder of the world total was accounted for by a production of about three million tons in the fields of Galicia and Rumania, a little in Peru, Persia and Japan, and minute quantities in Egypt and Trinidad. War and revolution put out of action temporarily the European sources of oil, though the resulting influence on world supplies in general is less than the figures suggest, since much of the Russian production was consumed internally. In spite of war conditions, the world output in 1919 had risen to about seventy million tons. Of this some seventy per cent. is to be credited to the United States, over twelve per cent. to Mexico, under five per cent. to the

Indies, Dutch and British together, with a very doubtful seven or eight per cent. to Russia. The rate of increase in America is higher than that for the world as a whole, and the most rapid rate of all, though on a comparatively small total, is to be found in Mexico. A first inspection of the figures seems to prove that the United States in oil no less than in coal, is in a position to dominate the whole world. Figures talk; but their language is easy to misinterpret. Let us turn to another set of figures to check our conclusions.

In 1920 the world total jumped to well over ninety million tons, with sixty-four per cent. for the United States and twenty-two per cent. for Mexico. America still maintains its lead over the world, but Mexico is gaining rapidly on the United States. The significance of this statement is made clearer by a glance at the figures of consumption. The United States, with the huge production of sixty million tons, yet found it necessary to import, mainly from Mexico, some thirteen million tons, or five times the import of 1913. In fact, the United States has now reached the stage in which native supplies are insufficient and the export of manufactured products is to be maintained only by import of the crude material. This, indeed, understates the case. The actual exhaustion of her native supplies may be a matter of the near future. An official estimate gives the life of the existing fields as about twenty years. The cause of American anxiety as to control of world supplies of oil in the future, and of her strong interest in Mexico, is very evident. We, in this country, as large consumers of oil and oil products, are equally interested in the question of world reserves and the possibility of the substitution of oil for coal.

Of the lighter constituents of oil, in their uses for motor traffic, it is not necessary to speak, since here is no case of direct substitution for coal, but rather the development of a new and additional motive power. The use of oil for heat and light in large areas of the world remote from coal sources, and the use of oil for lubrication, are outside our ken; though it must not be forgotten that such uses absorb a vast quantity of oil in one form or another. We are, however, assured that oil is to produce a revolution in the mechanism of transport, particularly in that of ships, and we hear every day of new ships built to run on oil.

The substitution of oil for coal on a particular ship is purely a matter of relative cost at the moment. We are told that the saving as compared with the cost of coal, ranges from twenty to seventy-five or eighty per cent. on that cost, according as we use the oil for raising steam or in various types of internal combustion engine. There are gains in space, in wages, in bunkering time and in convenience, but there can hardly be said to exist at the moment sufficient data to determine at what prices coal and oil must sell to compete on equal terms for any particular type of shipping. One thing is clear: the greater the gain by the use of oil the more rapid is the substitution likely to be; but it is one thing to run the Navy or a few first-class merchant ships on oil, it is quite another to so run the transport of the world, together with some of its manufactures.

Machinery and ships have a fairly long life. Will the exhaustion of American supplies send up the world price of oil within a few years, or can we trust to the development of new supplies? What, in short, is the world position? We have seen that the life of the great coalfields is estimated by centuries or thousands of years and a single pit may be worked for decades. The life of an oil well is to be measured by months; it may be exhausted in little longer time than it takes to drill. The life of a whole field may be little more than one generation of men; estimates vary from twenty-five years to a sanguine seventy. Long before exhaustion is reached, the cost rises above the competitive level of coal.

Oil is widely distributed in the crust of the earth, but its commercial availability is largely a matter of geological accident. Hence much of the uncertainty, the gambling element in prospecting. Even if a great "pool" be found, it is strictly limited in quantity, though it may give a vast temporary supply. The oil, like the coal, is a relic of a remote geological past, not a continuing product of the present. The quantity of coal in the proved areas can be measured with a fair degree of accuracy; with oil this is not so. The two great oil areas of the recent past already show evident signs of decay. More or deeper wells for the same flow of oil mean higher capital cost of production. Experience alone can show when the limit of profitable work is reached. Doubtless there are vast oil areas in the remoter untested regions of the world, and oil can be transported for long distances; but as the source of oil becomes more remote from Western Europe the extra cost of transport increases its delivery price for local use. Ships, however, can take in fuel on any part of the voyage; so that the real question for sea transport is as to the future cost, and this depends on the quantity of future supplies.

The enormous increase in the use of oil in the early part of this century was concurrent with a rapid rise in the world production of coal. It was not so much a case of substitution as of new uses. Substitution involves a still greater growth in the rate of increase in oil consumption. What such substitution might mean is illustrated by the figures of import into the United Kingdom in 1921 as compared with 1913. While the total receipts of all oil and oil products rose from about 490 million gallons to over 1,150, fuel oil alone rose from 95 million to 530 million, showing twice the rate of increase recorded by motor spirit. Conditions in 1921 were abnormal, but 1920 gives almost the same proportion.

Attempts have been made to estimate the world reserve of oil. A somewhat pessimistic view assigns fifty to a hundred years as the limit of the larger reserves at the rate of consumption of recent years. Yet this rate is accelerating from year to year beyond all possibility of reasonable forecast. The brake on the movement will come long before the stage of actual exhaustion. It will come in the form of a rise in price owing to the increasing cost of production. Whatever period we may fix for the exhaustion of oil, it is likely to be short in proportion to the life of coal, and long before that stage is reached the rise in the price of oil will offset its advantages over coal, even coal employed on the present wasteful and inefficient methods. The economies possible in the use of coal for raising steam are not by any means exhausted, and every such economy lengthens the life of the world's coalfields and shortens in comparison the age of oil.

The United States is extremely rich in stores both of coal and oil ; yet, after a single generation of thorough working, while the coal is hardly touched the oil is within sight of the end. There is, at present, no evidence to show that the history of the world as a whole will differ greatly in regard to these two sources of power. The onus of proof lies on the advocates of oil.

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